STAR Annual Safety Review

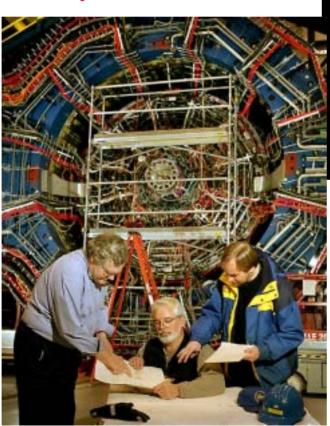


W.B. Christie, BNL

October 30, 2006.

Outline

- The STAR Detector for Run 7
- Plan for Operations/shifts
- Walkthrough of Sub Systems
- Interlocks
- Summary

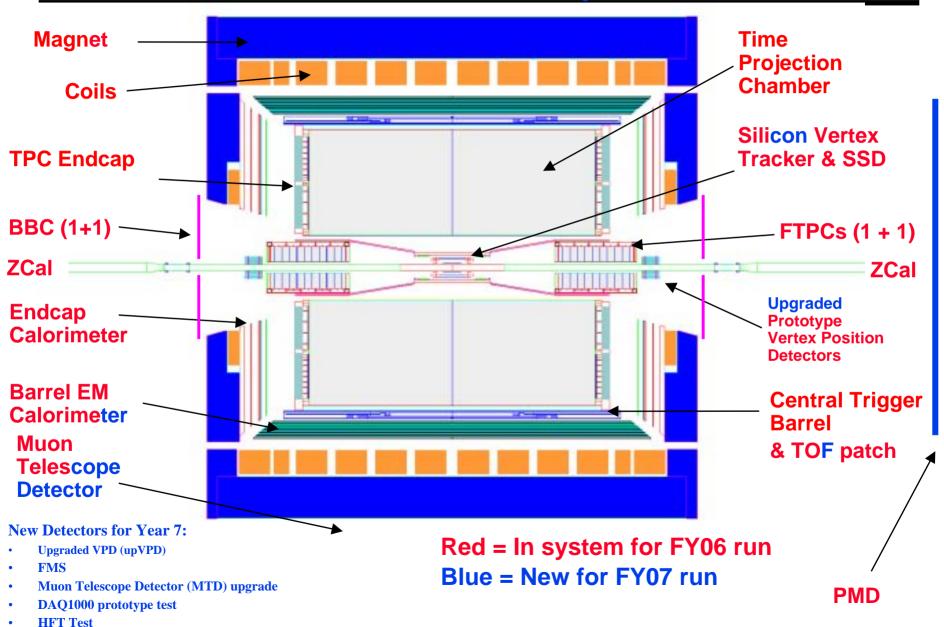


New for FY07 Run:

- Muon Telescope Detector upgrade
- $FPD++ \Rightarrow FMS$
- Upgraded pVPD
- Prototype DAQ1000 test
- HFT test
- Moved SVT RDO boxes
- Separated LV to BEMC PMTs
- TOF changes

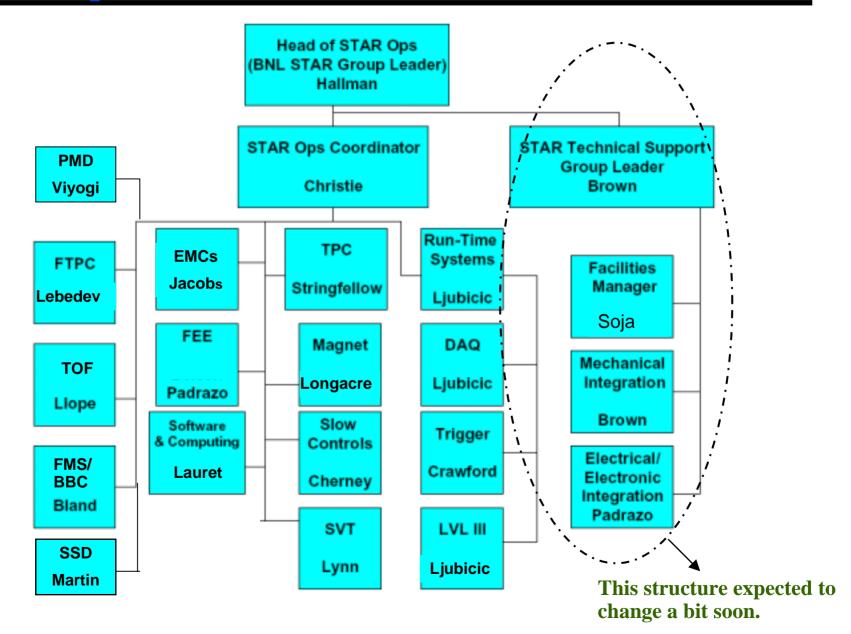
The STAR Detector for the FY06 Physics run





Plan for Operations and Shifts





Plan for Operations and Shifts



- Shift Staffing Plan (No changes, worked well in FY06 run)
 - Shift Leader
 - 2 Detector Operators
 - Run Control/Trigger/On & Offline QA
 - Shift term will be 8 days (one day of overlap)
 - Shift crew will be stable (i.e. same set of people) for duration of shift term

Great Wall of Cybersecurity



Four person Shift Crews



Sub Systems - Time Projection Chamber (TPC)



1. Configuration: Full TPC used

Small MWPC gain chamber mounted inside the TPC return gas manifold (west side at 12:00). Chamber has a 100 microcurie Fe55 source inside. HV is interlocked the same as the TPC.

2. Voltages:

TPC inner sectors 1170 V
TPC outer sectors 1390 V
Gain Chamber 1400 V
TPC Cathode Up to 35 kV (nominal 27.0)
Gated grid 115 V with a swing of +-75 V
FEE & RDO power +/- 8V
Two lasers with no exposed beams

3. Gas system:

Main TPC gas is P10 (10% Methane, 90% Ar)
Purge flow rate = 120 lpm for a total
of 3 volume exchanges (TPC volume = 50,000 l)

Normal recirculating flow = 560 lpm with 14 lpm vented out the stack (stack located on the east wall of the STAR assembly building with the vent exit above the level of the berm retaining wall.)

Insulating gap gas is N2 - flow rate is 10 lpm out the vent stack.

N2 is also used in various places in the gas system, laser system and water system - total flow ~ 50 lpm vented to the room.

- **4. Water cooling** the TPC FEE & RDO are cooled by a closed loop water cooling system. Heat exchange is to the STAR MCW. Total volume is ~500 gallons and flow rate is 320 GPM. The system is located in the second floor utility room at STAR. No water is released to the environment.
- **5. Safety interlock:** The TPC has an Allen-Bradley SLC interlock system. The main system is located in the gas mixing room, with a remote slave system located on the second floor south platform. The SLC is used for equipment protection, and is closely linked to the STAR SGIS. The TPC system provides interlocks and alarms for the TPC HV and LV. Adding small delays (~1 s) in kill signals, and adding surge suppressors to system.

6. No new procedures.

Other than installing updated prototype FEE cards and 1 updated RDO board (presented next), no changes for FY06 run.

Prototype "DAQ1000" Test Configuration



The Proto type development system will be revised for the FY07 Physics run. It takes the place of one of the current TPC Readout Boards and 29 FEE cards.

There are five new elements to the development system:

- 1) New DAQ1000 full size readout board with support for 36 FEEs.
- 2) A lower voltage (6 volt) Linear single power supply.
- 3) New version of the FEE boards.
- 4) An adapter cable from 6 pins to 4 pins (use original 90' power cable).
- 5) 50 pin ribbon cable to connect FEE boards to the readout board.

Photos of DAQ1000 test Component boards

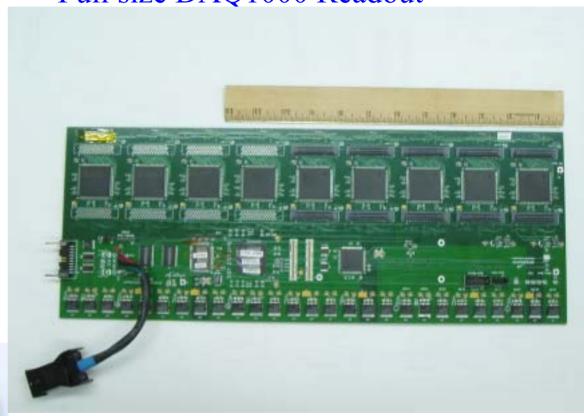


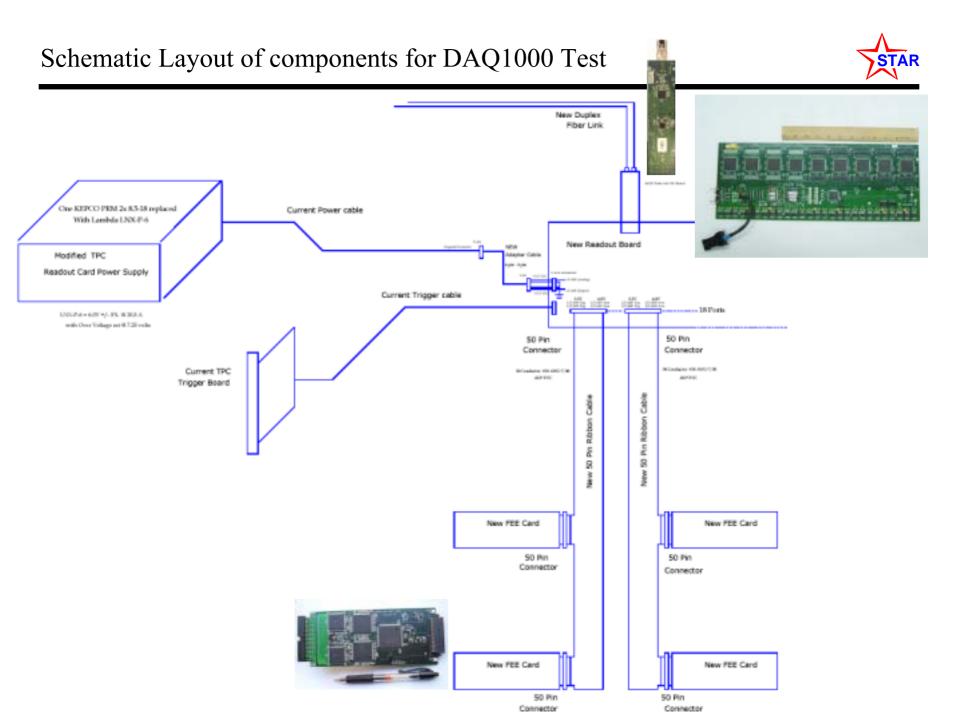
KJHDkjshdkjshd

TPC FEE card



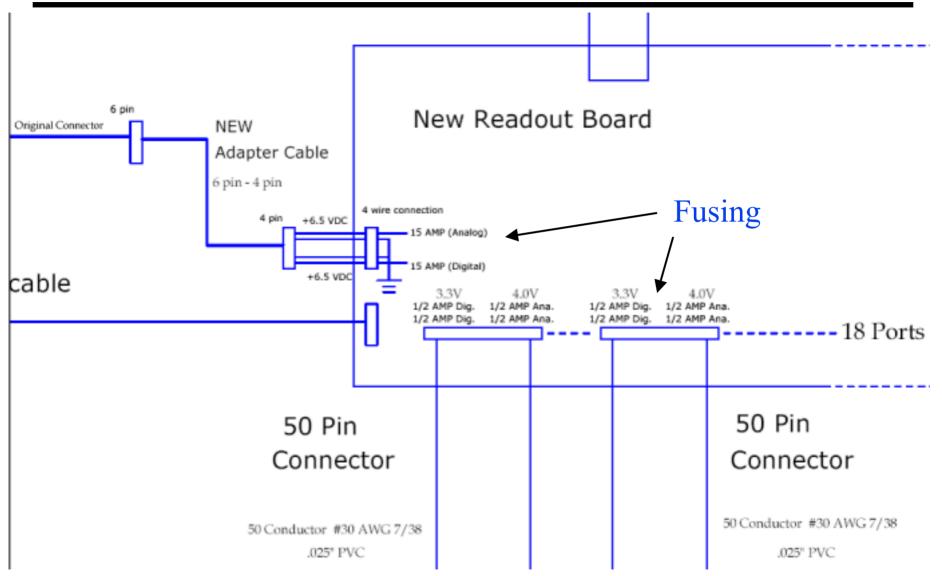
Full size DAQ1000 Readout





Fusing for DAQ1000 prototype test boards





Sub Systems - Silicon Vertex Tracker (SVT)



1. Configuration: Full SVT used

(3 barrels = 36 ladders = 216 wafers = 103,680 channels)

2. Voltages:

SVT high voltage 1500 V (fully enclosed, I < 9 mA) FEE & RDO power +/- 8V calibration voltages < 20V One class 2 laser with no exposed beams

3. Gas system: no gas system

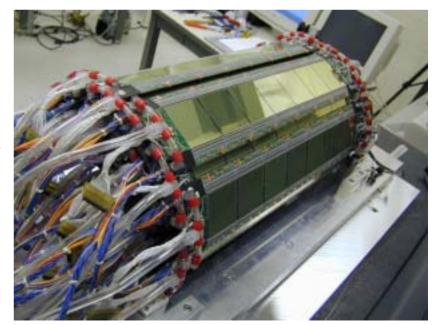
4. Water cooling:

- a.) the SVT front-end electronics (on-detector) are cooled by an independent closed loop water cooling system. Heat exchange is to the wide angle hall. Total volume is ~45 gallons, the volume of water in the system is 32 gallons. The maximum system pressure is 30 psig, however all elements inside the SVT are below atmospheric pressure. The nominal flow rate is 6 gpm at a nominal water temperature of 75 F. The system is located on the first floor of STAR North platform in the Wide Angle Hall. No water is released to the environment.
- b.) the SVT RDO boxes are cooled by the TPC RDO closed loop water cooling system. The nominal flow rate through the RDO boxes is 12-19 gpm.

5. Air cooling:

a.) the SVT is air-cooled from outside the TPC wheel. An air manifold is mounted to the TPC wheel. The air is pumped into the SVT volume from the West Side and released to the Wide Angle Hall on the East Side. The operating pressure will be less than 0.8 in. H2O (2 mbar). The shut off pressure is 2 in. H2O (5 mbar)

The nominal temperature is 75 F and the maximum flow rate is 600 cfm (17000 lpm), however we expect much less.



Sub Systems - Silicon Vertex Tracker (SVT)



6. Safety interlock:

The SVT has a custom-made relay driven interlock system for equipment protection. The main STAR system is located on the STAR south platform (2nd floor). The system is closely linked to the STAR SGIS. The SVT system provides interlocks and alarms for the SVT HV and LV, plus RDO crate over temperature and the RDO water system flow and temperature. In order to turn on the SVT-LV the following permissions have to be granted:

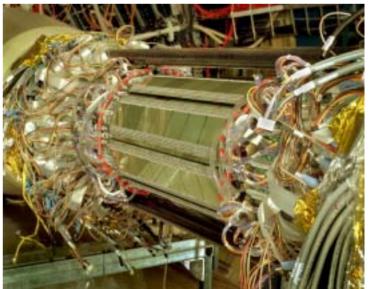
- a.) global (from SGIS) (requires tpc water flow, inner field cage air flow and all other global locks)
- b.) no-leak (from trace-tek via TPC Allen Bradley) (requires no water leaks in any connected system)
- c.) SVT water (from thermal dispersion flow switch located in svt water system) (requires SVT water is flowing)
- d.) SVT water temperature (from temperature switch in svt water system) (requires that svt water temperature does not exceed 100 F).
- e.) Water pressure less than zero. SVT water, power, and HV shutdown if water pressure is/becomes positive.

The SVT-HV can only be turned on if the SVT-LV is on. The SVT leak detection is also incorporated into the STAR SGIS. In case of a leak the SVT water pump will shut off.

7. No new procedures.

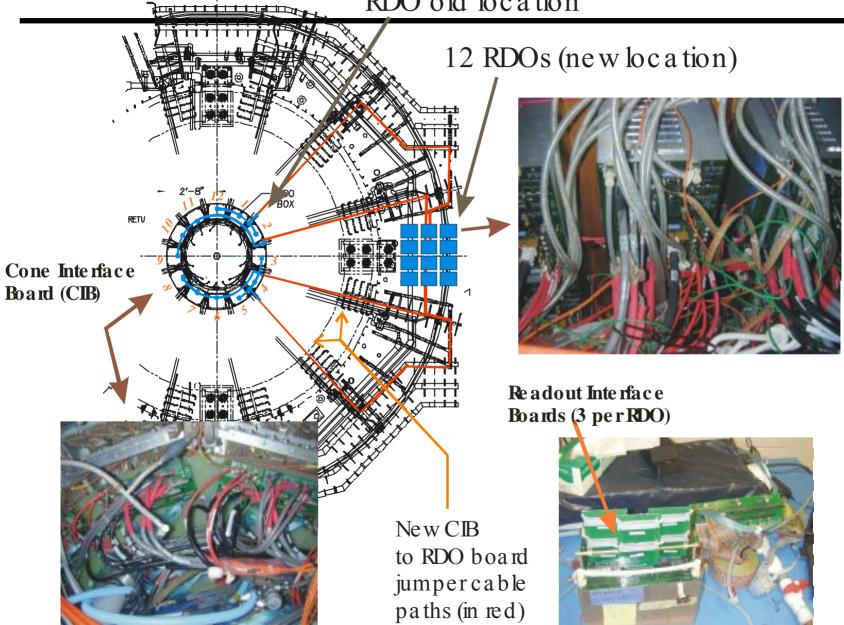
RDO boxes relocated (to make maintenance during run possible) for FY07 run.











New Elements for the SVT RDO Relocation



Readout interface Board

Routes two 50 pin round-to-flat signal cables to one 100 pin custom connector on readout box.

Cone Interface Board

Serves as a "patch panel" for installed jumper cables described below:

Signal Cable Assembly

34' – 50 Conductor round-to-flat Cable Assembly Pt# SVTRDO-50-34

25' - 50 Conductor round-to-flat Cable Assembly Pt# SVTRDO-50-25

Two 50 conductor round-to-flat (i.e. standard twisted pair) cables mate to one custom 100 conductor twin-ax cable at Cone Interface Board.

Power Cable Assembly

34' 12 Conductor 16AWG Power Cable Assembly Pt# SVTRDO-12-34

25' 12 Conductor 16AWG Power Cable Assembly Pt# SVTRDO-12-25

Each 12 conductor 16 AWG power cable mates to one existing 12 conductor 18AWG cable at Cone interface Board. All voltages less than 6 volts and 1.5 amps/conductor.

High Voltage Cable Assembly

34' – RG-59u High Voltage Cable Assembly Pt# SVT-HV59-34

25' - RG-59u High Voltage Cable Assembly Pt# SVT-HV59-25

Each Rg-59u cable assembly mates to existing cable assembly at Cone Interface Board.

HV = -1500 volts, current < 8 mA



Sub System - Silicon Strip Detector (SSD, No changes for FY07 run)

1. Configuration: 20 SSD ladders (10 ladders in FY04 Run). (Full configuration = 1 barrel = 20 ladders = 320 wafers = 491,520 channels)

2. Voltages:

SSD Wafer : $50 \text{ V} (I_{op} < 200 \text{ } \mu\text{A}, I_{max} < 1 \text{ } m\text{A})$

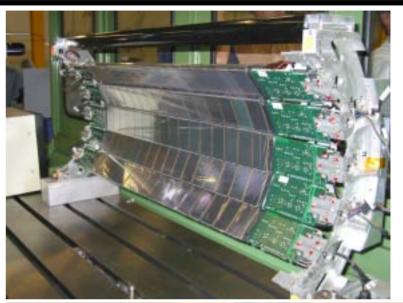
FEE power : $\pm -2V$

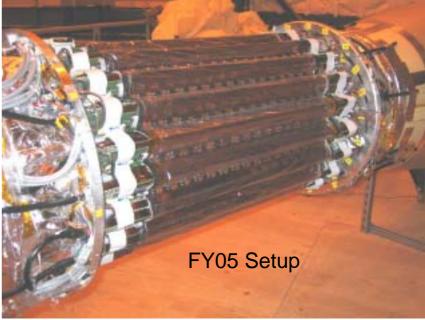
ADC, Control and RDO power: +7V, +5V

3. No water cooling or gas system.

- **4. Air cooling :** The SSD ladders and its RDO boards are air-cooled. The air is taken from the IFC, pulled through the ladder and released to the WAH. Four vortex (transvector airflow amplifier) installed on the Pole Tips use 8 bars compressed air and induce an airflow (1 liter/s). The nominal temperatures are : 30°C on the wafers, 35°C on the ladder boards and 60°C on the RDO boards.
- **5. Interlocks :** The SSD interlock system is closely linked to the SGIS. It uses a custom-made relay driven system integrated in the SSD slow control crate located on the STAR south platform. The SSD power supplies and the cooling system can be turn on only if the following permissions are granted :
 - •IFC permissive (from SGIS)

The internal Slow Control allows one to monitor the wafer and board temperatures and to turn off the SSD voltages in case of an air cooling system failure.





Sub Systems - Forward TPCs (FTPC)



1. Configuration:

- i) Both FTPCs in the same configuration as for the previous run.
- ii) 2 TPC lasers (class 4) used; no open beam

2. Voltages:

Anode voltage (readout chambers):1750+/-50 V

Anode voltage (DVM): 1200+/-50 V

Drift voltage (FTPC): 12.5+/-.5 kV

Drift voltage (DVM): 6 kV

Low voltage (FEE + RDO): +/-8 V

Gating grid voltage: 180 V

3. Gas system:

Gas mixture: Ar/CO2 (50/50)

Purge flow: ca. 200 l/h and chamber

Operation flow: 50 - 100 l/h and chamber (in purge mode,

will be higher in circulation mode)

Location: Gas mixing room Exhaust to gas mixing room

4. Water cooling:

Water cooling for FEE and RDO boards

Supply system is closed circuit at low pressure (leakless) with

heat exchanger to MCW

Total water volume: < 10 gallons

Flow: < 1.0 g/min

Supply system is located on 1. level on North platform

No water release to environment

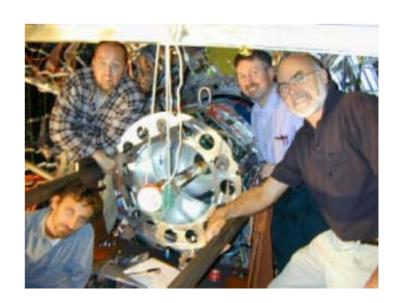
5. Safety interlock:

The FTPC interlock system is closely linked to the SGIS (Star General Interlock System) and the TPC interlock. TPC interlock outputs are fed into the FTPC system and are processed through a relay ensemble to control LV and HV. LV are also interlocked to the FTPC cooling system.

Under development, and expected to be operative before the run starts, are the HV interlock that inputs from the FTPC gas system and the cooling system interlock connected to the STAR water detection system.

6. Procedures: No new procedures for run 6.

No changes for FY07 Run.



Sub System - Barrel EMC



1. Configuration: All 120 EMC modules were installed prior to the RHIC FY05 run period.

3. Voltages:

EMC barrel PMT: 1470V fully enclosed and less than 10ma.

SMD wires: 1430V operating, 1500V maximum, fully

enclosed and less than 10ma.

FEE & RDO power: +/- 8V max.

No lasers.

- **4. Water cooling:** The SMD FEE electronics are cooled by a closed loop water cooling system.
- **5. Safety interlock:** The EMC has a relay based interlock system. A feed from the TPC interlock system includes water leak detection and HV and LV permissives from STAR.

EMC local interlocks include:

SMD water system flow and temperature

Crate power supply over voltage and overcurrent.

Crate over temperature.

SMD FEE over temperature.

- **6. PSD:** Same architecture as SMD with PMTs in place of wire chamber. All HV fully enclosed, power and grounding like SMD. Uses RDO hardware identical to SMD.
- **7. Remote LV Power supplies for the BEMC Electronics crates:** The LV power is supplied to the BEMC tower crates from supplies located in Rack row 2C on the South Platform. New for this year, the LV for the PMT boxes is supplied from separate, new supplies, and routed over new cables and paths. This is a full scale implementation of the system that was tested last year.





Barrel Shower Maximum Detector (SMD)



1. Configuration: 120 modules (complete system) and conventional systems for them installed. Full readout electronics installed.

Notes: SMD Modules require High Voltage, Gas Flow, Water Cooling and all grounds are electrically isolated from the EMC and each other.

2. Voltages:

HV supplied CAEN model SY1527. Caen supply is modular, multichannel with 4kv max per channel hardware limited to 1.5kv, 3ma/channel max, software limited to 5 uamp. SMD HV - 1430 V

3. Gas System:

Gas Bottles/Initial Supply Manifold located immediately outside door of gas utility room in STAR hall. Stepdown regulator located on third floor south platform of STAR Detector. Bubbler arrays located at 10 o'clock/2 o'clock West positions on backleg steel and West side magnet supports near 8 o'clock/4 o'clock positions.

SMD Gas is 90%Argon-10%Carbon Dioxide at low flow and atm. pressure.

Maximum Supply Pressure to Modules is 9 PSI

Pressure inside the SMD module -12 mm H2O above atmospheric at nominal gas flow. Total Gas Volume ~ 120,000 cm**3

Modules are ganged together in pairs, i.e. 120 modules = 60 pairs Nominal Flow Rate - 10 cm**3/min /module Total Nominal Flow rate - 1200 cm**3/ min

Gas is low flow, low pressure and non-hazardous. Accidental overpressure of supply line (>50 PSI) vented outside building.

Gas is vented outside magnet thru system of bubblers into hall. Gas Flow is monitored by remote TV cameras on array of bubblers.

4. Water Cooling:

The SMD FEE are cooled by a closed loop water cooling system. Heat exchange is to the STAR MCW.

Total volume is ~ 1 liter, total flow rate ~ 100 cc/s.

Cooling water circuit supply/return rings on West end of

Magnet. Cooling loop installed on East end of magnet.

Routing to detectors through plastic hoses with separate shutoff valves at 6 places around the ring on the West end of the magnet.

Water may be shut off at manifold on NorthWest floor level of STAR detector.

No water is released to the environment.

Supply Pressure = 110-120 PSI Return Pressure = 23 PSI

All circuits pressure rated to 245 PSI @ 100F Installed heat-exchangers tested to 150 PSI to UCLA, all circuits tested being installed to 110-120 PSI.

5. Safety Interlocks:

High Voltage has hardware interlocks similar to the SVT subsystem.

Front End Electronics has temperature-sensors to shut off low voltage in case of loss of chilled water.

Gas system has a vent valve outside of the building in case of accidental overpressure of the supply line.

No changes to system from last year.

Sub System – Endcap EMC (EEMC, No changes for FY07 run)





<u>Configuration</u>: Full structure mounted on west STAR poletip; all twelve 30° sectors loaded with tower scintillator megatiles and extruded strip Shower Maximum (SMD) modules (Same as last year).

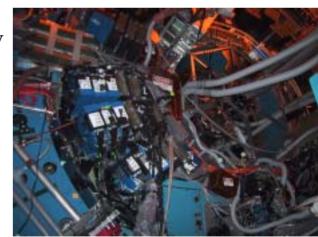
<u>Instrumentation</u>: Magnetically shielded PMT boxes and readout for all 720 towers (12 sectors) on back of poletip. Readout of Multi-Anode PMT boxes for all sectors of SMD, PreShower and PostShower layers.

<u>Power & Interlocks</u>: Supplies and electronics crates in rollaround racks w/ shore or platform power; local smoke alarm trips rack shunt breakers.

<u>Voltages</u>: HV (\sim 1000V) for PMT/MAPMT supplied via CW bases; HVSys made controller supplies 160V and safety shutdown features; LV power (WIENER) supplied remotely to tower crates at \pm 5V, \pm 12V and MAPMT box FEE electronics via distribution panels at \pm at 7V, \pm 4V.

<u>Water Cooling</u>: MAPMT boxes cooled by commercial closed-loop chiller system with ~ 10 gallon total volume; local safety interlocks.

<u>Laser</u>: Nd/YAG (λ =355nm), primary 11mJ/pulse @ 10Hz; west tunnel operation enclosure, split and delivered via (closed) fiber distr network; misc. monitoring PMT's, diodes and electronics



Sources: sealed 300 μCi ⁶⁰Co used only in test/calibr mode when poletip is removed from STAR; small alpha test sources enclosed in level #2 laser splitter boxes on back of poletip.

Photon Multiplicity Detector (PMD, No changes for FY07 run)



- **1. Configuration:** Complete PMD detector in place for the FY05 run.
 - All rack mounted electronics in place
 - Full gas system in place
 - Full beam support system in place
 - 24 detector modules (complete system)

2. Gas System:

- PMD gas system is a single pass design. Same as used in FY04 run.
 - Gas composition is 70% Argon & 30% CO2
 - Total flow rate is ~ 50 l/hour
 - Gas is vented to gas mixing room

3. Voltages:

- HV is provided by LeCroy 1454 supply
- Detector is operated at 1450 V
- LV is ± 2.7V, provided by Weiner commercial supply

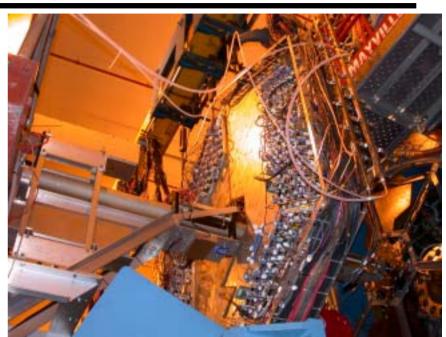
The LV distribution box was redesigned during FY04 run with active current monitoring and tripping circuits.

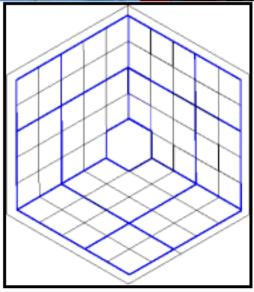
4. Interlocks:

- Local smoke interlock on racks, SGIS power crash button

5. Procedures:

- System will be run by experts at start of FY04 run, with plan to turn over to shift crew during the running period.

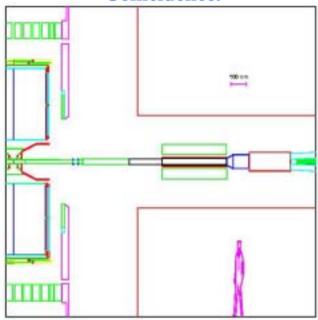




Sub Systems - Trigger

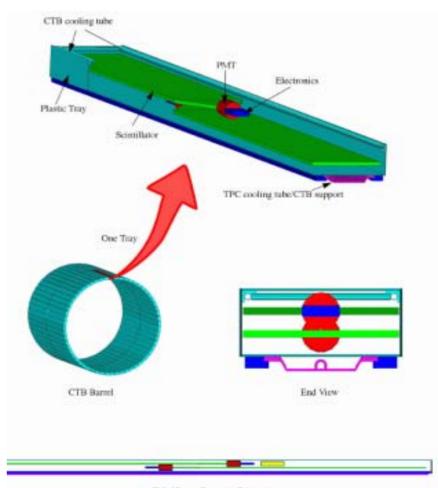


Zero Degree Calorimeters (ZDC) Coincidence.



- 1. The CTB will operate with 119 of 120 trays installed.
- 2. a. The PMT voltages are from current limited LeCroy supplies set for maximum HV of 2200 V.
- b. 10 VME crates operate at 220V and 2.3kW each.
- 3. no gases 4. no liquids

Central Trigger Barrel (CTB) Summed ADC Threshold.



Beam Beam Counter (BBC)

STAR

1. Configuration:

- System fully operational since FY04. No changes planned for FY06 run. PMT boxes have continuous thermal monitoring.
- Readout is via "trigger" electronics.
- 2. No gas system or water cooling.

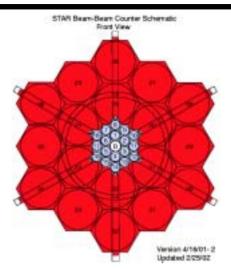
3. Voltages:

- The PMTs for the BBC operate at an average cathode voltage of -1400 V.
- The HV is supplied by a LeCroy 1440 system located on the South Electronics platform

4. Interlocks:

The electronics and HV systems for the BBC are housed in electronics racks on the South platform. These are standard STAR racks and have have standard STAR interlock features (e.g. rack based smoke and water leak protection, power shutdown via SGIS).

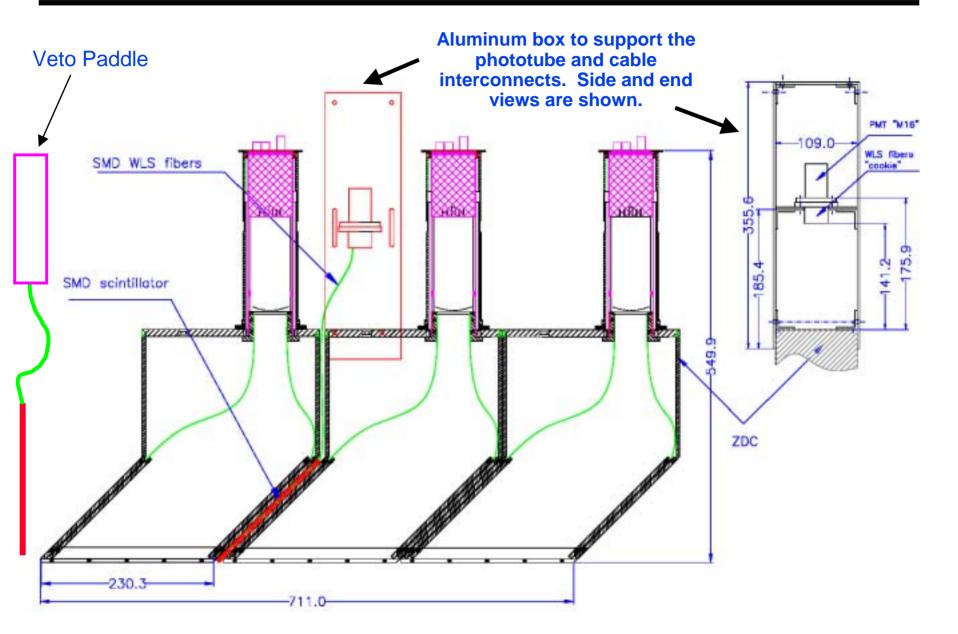






ZDC elements (No changes for the FY07 run)

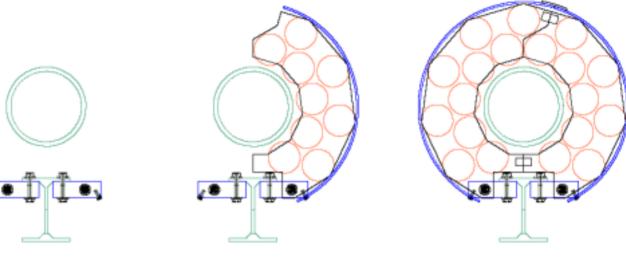


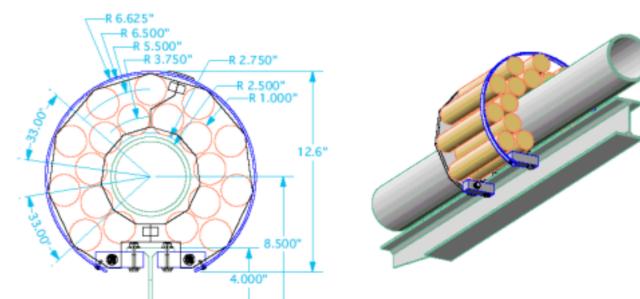


upVPD Layout for FY07 Run



38chs of mesh PMT+no magnetic shielding. Installed briefly in Run 6. PMT bases changed last year (FY06 run).





upVPD Detector Assembly Details



upVPD Detector Assys

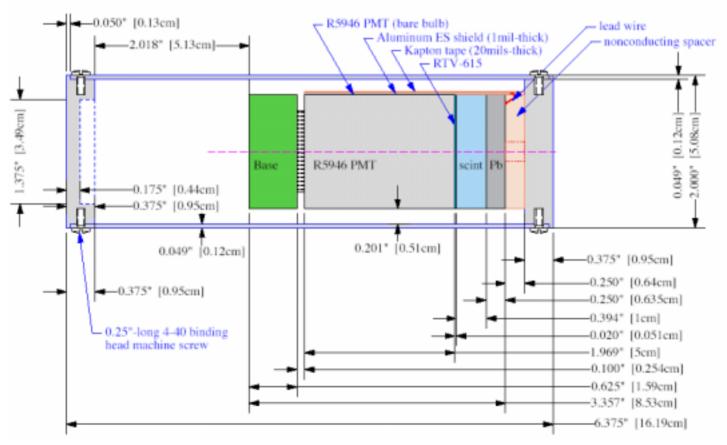
Outside of detector elements labeled: "Lead enclosed, do not disassemble"

parts:

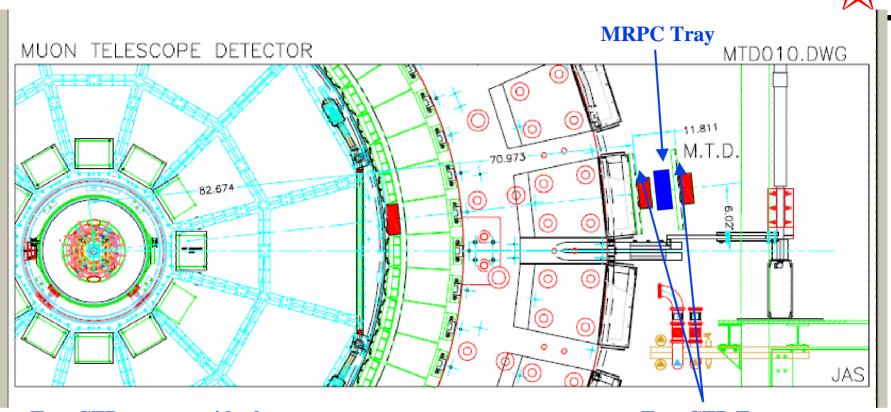
- thin-walled Al tube, OD 2.00", wall 0.049", length ~ 6.375"
- Front cap piece
 - (Al, 0.375"-thick, OD=1.902", w/ 2 tapped 1/4-20 holes)
- 3. Rear cap piece
 - (AI, 0.375"-thick, OD=1.902", w/ 2 keyed holes for conn plus 4 tapped holes around outside for 4-40 screws)

Qty needed = fifty (50).

PMTs from TOFp.



Test Muon Telescope Detector (MTD, updated for FY07 run)



- Two CTB trays outside the magnet
- Same as the CTB inside the magnet
- 4 HV cables, 4 signal cables; all same as the CTB trays inside the magnet
- HV from existing CTB HV (LeCroy) supplies
- Signals digitized by existing Trigger digitizer channels
- CTB tray cases on same ground as magnet

Two CTB Trays

New MRPC Tray

- Modules fabricated by USTC group
- 2 Modules/tray
- Module is 20 cm x 89 cm with 6 strips

Equipment for New MTD MRPC Tray



Electronics:

- 24 Amplifiers, produced by Rice U., same as used in PHENIX TOF system.
- Analog signals feed Trigger Digitizer Boards.

Power Supplies:

- LV: Will use TOF LV channels from new TOF LV supply.
 - Operating voltages: +4.5V @ 1 A, $-8.5V \sim 0.5 A$
- HV: CAEN SY1527LC Mainframe equipped with 4 modules (New)
 - 2 A1534P modules, 6 channels/mod., 0 to 8 kV @ 200 uA max.
 - 2 A1534N modules, 6 channels/mod., 0 to -8 kV @ 200 uA max.

Cables:

- Analog signals carried on 75' of RG8X-7808 cables (BNL & LIMO).
- LV Cables: One pair of 6 AWG conductors (DC power) and one pair of 22 AWG twisted pair (remote voltage sensing). Bundled together (TOF cable).
 - HV Cables same as TOF, 15 kV rated CPE HV mating Connectors.

Gas:

- Freon (95%) + Isobutane (5%), 60 cc/min., feed via Polyethylene from TOF system.

Patch TOF (TOFr) & upVPDs



Each upVPD contains 19 PMTs

- Located on each side of STAR, on beampipe support
- Same readout electronics as for FY05 run.

MRPC TOF patch (TOFr5)

One "tray" with 32 MRPCs, with new onboard electronics. The first layer of FEE, called TAMP, also closes the gas box. TAMP only does the preamplification and input protection. A second layer, called TDIG, does the discrimination, digitization via HPTDC, and data buffering. This is how the full system will be. Water flow similar to Run 4. Gas flow same as Run 4.

Gas System:

- R134A, 63ccm
- isobutane, 3.5ccm
- SF6, 0-3.5ccm

all vented to the atmosphere, outside through a stack

Voltages Used:

HV - +/-8kV, <50nA, total for MRPCs

LV - +4.2 V/+4.2 V/-8.5 V, 16A/11A/3A, ~140 W total

Interlocks:

pVPD system: Same as run 5.

TOFr5:

Power to racks is dropped upon loss of STAR global interlock. This drops HV and LV. Interlocks also in gas mixing room. Senses for isobutane content. Stop gas flow upon loss of SGIS gas permissive.

Same as last Year????

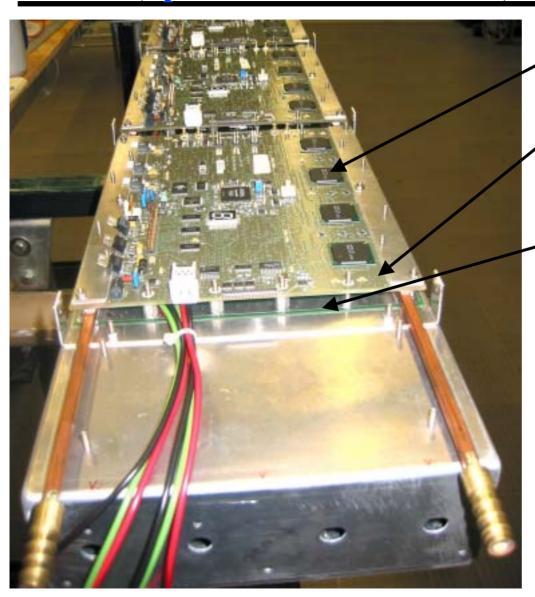
Procedures:

HV and gas system same as last year.



TOFr5 (update for FY07 run???)





HPTDC chips

TDIG layer

Discrimination, digitization via HPTDC, and data buffering

TAMP layer

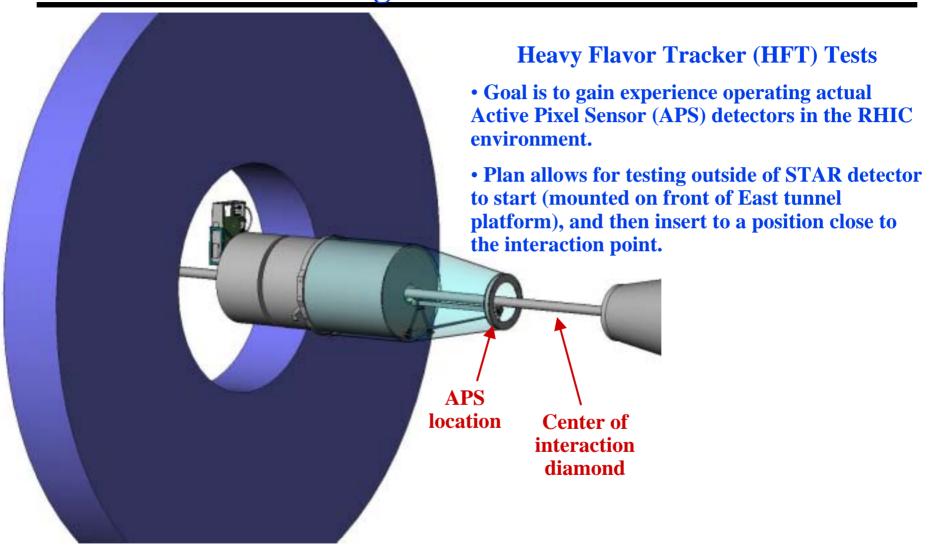
Preamplification and input protection

With the exception of possibly exchanging a few of the 30+ MRPC modules, same as last year.



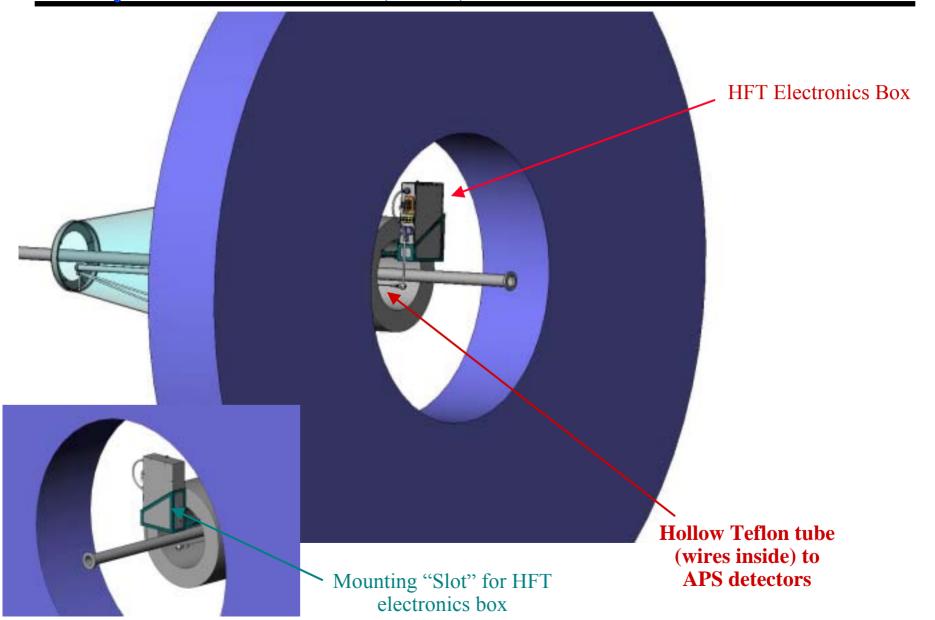
View of HFT test configuration from inside STAR





Heavy Flavor Tracker (HFT) Tests



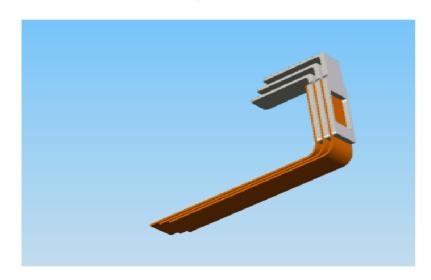


STAR Heavy Flavor Tracker – test of Si chips in Run VII

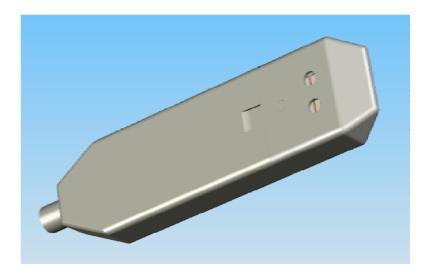


The STAR collaboration proposes to test three pixel sensor chips in Run VII (Winter 2006-2007). The chips are CMOS active pixel sensors (APS) based on MimoSTAR II technology. The chips will be stacked to form a 'telescope' and we propose to place them about 1 meter from the STAR interaction point (IP) and up close to, but not touching, the beampipe.

The maximum voltage on the Si chips is 3.3 volts because no drift voltages are required for an APS pixel sensor. The maximum voltage on any wire is 3.3 volts and the maximum current, integrated over all wires exiting the detector, is less than 1 amp.



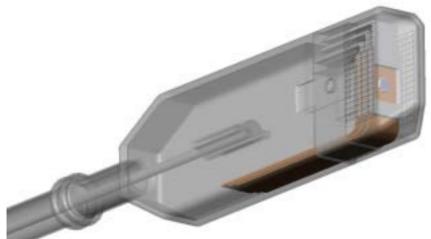
The essential elements are shown in the figure, above. The aluminum support arms are shown in gray and they support the Si chips and the ribbon cables that interconnect the chips to the outside world. The long axis of the aluminum support arms is approximately 1 inch long. The window for the Si chips is approximately 0.5 inches wide.



The chips and support arms will be enclosed in a small ventilated housing and cooled by pulling a modest vacuum through an attached flexible pipe which will come out the back of the housing. The total mass of the plastic housing is less than 50 grams.

Details on HFT Tube and air cooling plan





The APS Si pixel sensors mounted inside the plastic housing with the cooling tube attached.

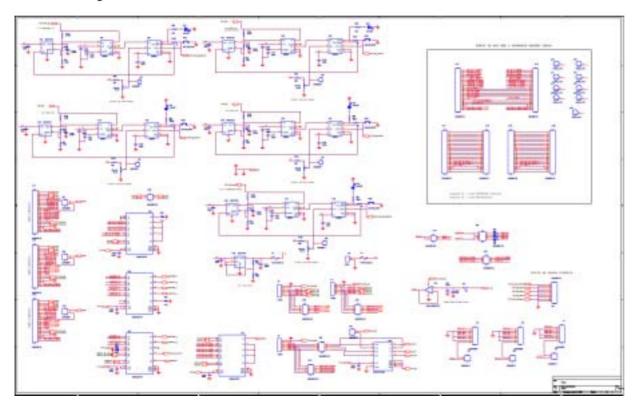
The flexible plastic tubing attached to the housing has an inside diameter of 0.5 inches, is approximately 2.5 meters long, and is made from Teflon PTFE which meets the Underwriters Laboratory 'vertical burn' specification for flame retardant materials UL94-V0. A small diameter carbon fiber rod runs down the center of the Teflon tube to provide stiffness when inserting and retracting the detector.

A system will be devised for air cooling that draws a regulated amount of air through the plastic pipe. If the air cooling fails, then the noise on the APS pixel sensors will go up and the gains will change. We do not expect any other significant consequences due to a cooling failure because the power dissipated in the test apparatus is so low (a few watts.)

HFT Electronics



Electrical connections to the chip will be made with 28 gauge twisted pair Cu wire. These wires are the same twisted pairs used in Cat 5 Ethernet cable, but our cables are individually shielded with an Al foil shield and then packed flat in a ribbon cable containing 4 twisted pairs per cable. Each ribbon is 0.25 inches wide by 0.1 inches thick. A maximum of 9 ribbon cables, and more likely only 4, will connect the Si chips to the external electronics.



The motherboard for the APS pixel sensors will be located outside the STAR TPC but inside the endcap for the magnet. A location inside the annulus of the STAR FTPC readout electronics box has been chosen for the location of the pixel sensor motherboards. This location is about 2.5 meters from the location of the pixel sensors.

The Motherboard is the source of all voltage and current going to the APS pixel sensors. The Motherboard is driven by the STAR MWC power supplies using existing wiring, however it only uses the +8 V provided by these supplies. Each motherboard is independently protected with a 5 amp fuse.

Forward Pion Detector (FPD, East side of STAR)



1. Configuration:

Modular Pb-glass calorimeters positioned left, right, above and below the beam line on the east tunnel platform extension.

Planned changes for run 7 are that the West FPD++ setup has been removed. FMS will take its place on the West side of STAR.

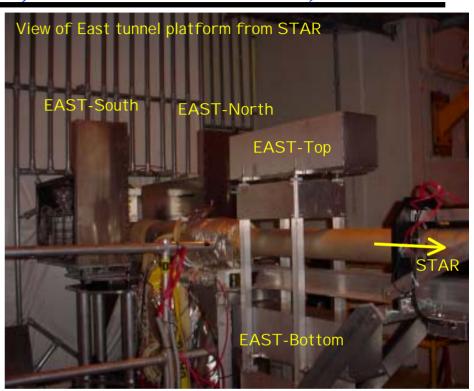
2. No gas system. New water cooling for FMS electronics (racks).

3. Voltages:

Typical voltages are -1700 V on photocathodes, supplied by LeCroy 1440 systems located on east and west walls of wide angle hall.

4. Interlocks:

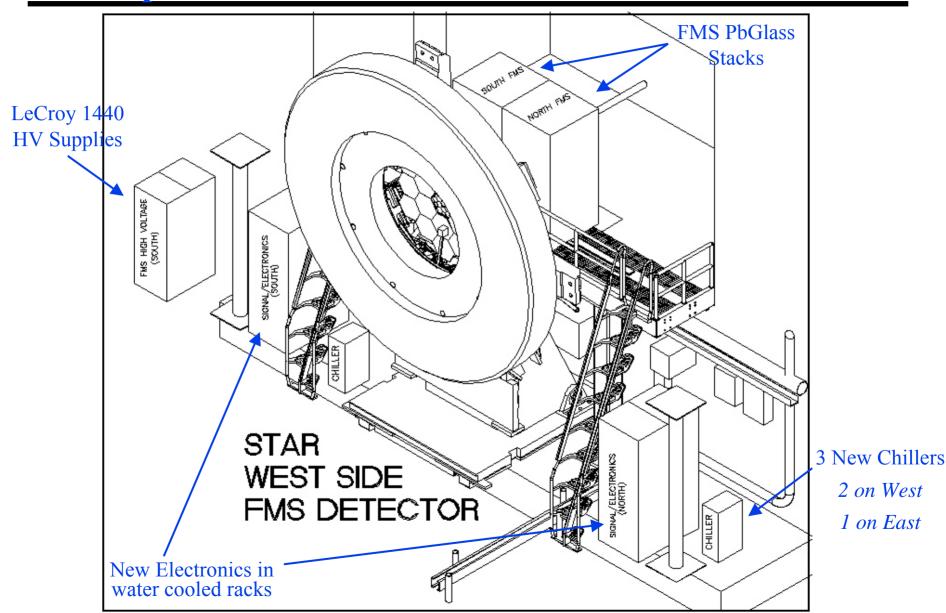
Electronics and HV system are housed in racks located on east and west walls of wide angle hall. These racks have local smoke detection interlocked with AC power.



No changes for East FPD for FY07 run.

FMS replaces FPD++ for FY07 Run

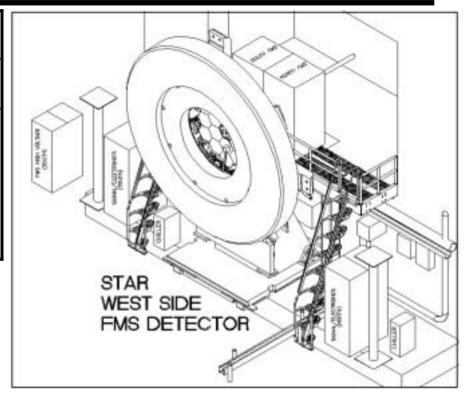




FPD++ for run 6 (Replaces West FPD)



| | Run-5 FPD | Run-6 FPD++ |
|-----------------|---------------------------------|---|
| Top/botto m | 5x5 matrices (cell A) | None |
| North/Sou th | • 7x7 matrices (cell A) | •14x14 matrices (cell B) |
| | • 7-cell (A) preshower | • 6x6 matrices (cell A) |
| | • Shower-maximum detector (SMD) | No preshowerNo SMD |



Cell A (36 / calorimeter)

• glass: (3.8cm)²×45cm; 2.5 kg

• PMT: FEU-84 (12 stage)

• resistive divider: 1400 V / 0.2mA

Cell B (168 / calorimeter)

• glass: (5.8cm)²×60.2cm; 10 kg

PMT: Amperex XP2202 (10 stage)

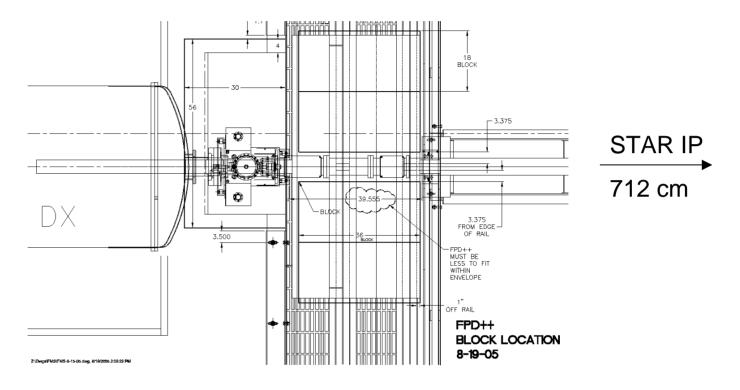
resistive divider: 1200 V / 1mA

Picture of South FMS before Light Tight Box





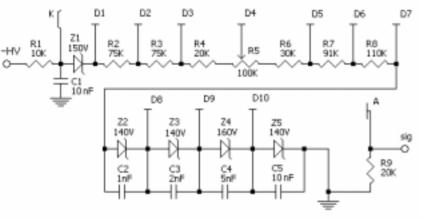




- north(south) calorimeter comprised of XXX glass blocks weighing ~X000 pounds
- lead glass calorimeters enclosed in light tight boxes
- calorimeters mounted on horizontally translating platforms (translate transverse to beam direction).

FPD++ Electrical





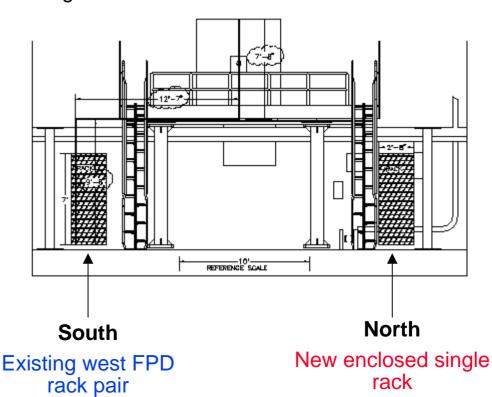
- Zener-diode stabilized resistive base for XP2202
- base soldered directly to flying leads
- components potted in silicone
- powered by LeCroy 1440 high voltage system
- CL-2 rated insulation on co-axial signal cables and high-voltage cables

South rack

- 9U VME crate (QT digitizers)
- 9U VME crate (DSM boards)
- LeCroy 1440 high voltage
- communications

North rack

- 9U VME crate (QT digitizers)
- LeCroy 1440 high voltage



QT Electronics Boards for FMS



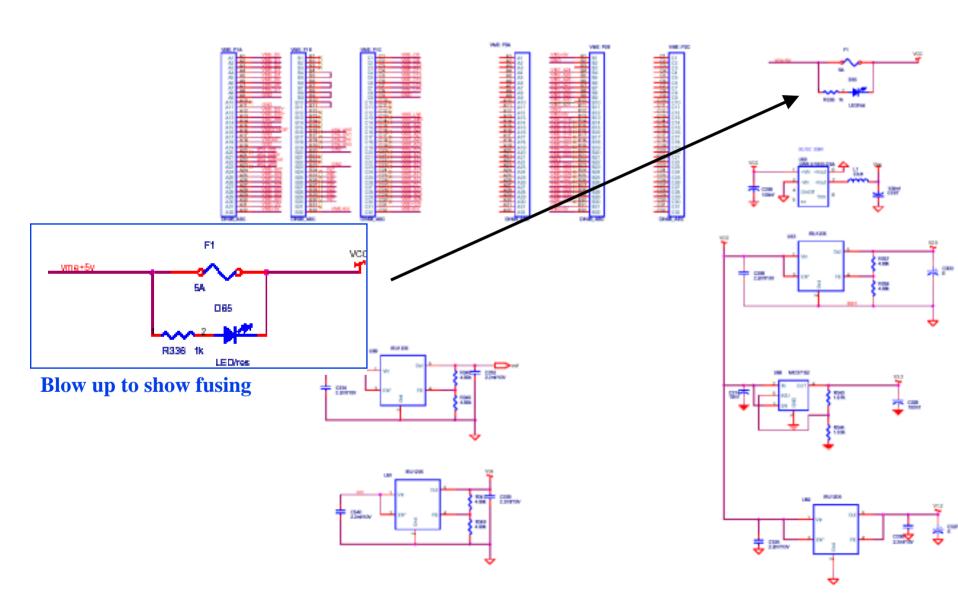
- Measure charge (ADC-0.25 pc/ 12 bit) and time (5ns)
- 32 channels per board
- 9U VME, 20W per board, 8 boards per crate
- 2 crates (STAR Standard VME crates)

Input: 50' RG58 PMT -> patch panel
Positronix 8x RG58 BNC from patch to QT input
(same as used for Tower Digitizers)
Timing (clocks) via 10pin 3M (as in trigger)
Output: through VME P3 to DIB cards (Trigger standard)
into existing DSM tree

5V line input with quick-acting 5A fuse

Schematic for QT Electronics Boards





STAR Magnet Operation



- •There is a new feature added to the STAR Global Interlock system which allows for ensuring protection against magnetic fields from the STAR magnet without the need to "rack out" the 13.8 kV line. STAR would like to get approval to utilize this feature to allow for brief accesses behind the magnetic field barriers without the need to "rack out" the 13.8 kV line.
- C-AD Power Supply group has updated fusing protection for the Magnet Power Supplies which should reduce the frequency of having to lock-out, and open, Power Supply cabinets. C-AD Power Supply group has also worked on other aspects of the Magnet Power Supply system, any additional details, if necessary, would have to be provided by them.



SGIS Interlock System



No changes to the STAR Global Interlock System (SGIS) for FY07 run!

Sounding the Alarm



Summary



Note: Environmental Emissions Document is complete for FY07

Still Pending:

- Get SGIS certified.

